SHORSHER, I.N.

Separation of molybdenite-pyrite concentrates. Obog. rud. 8 no.2:3-4 '63. (MIRA 17:2)

SHORSHER, I.N.

Methods of phase analysis of ores and concentration products for copper. Obog. rud. 8 no.3:40-41 '63. (MIRA 17:1)

[illegible], S. T., [illegible], S. T., [illegible], N. I.

"An analysis of the incidence of hemorrhagic nephrosonephritis in the Yaroslav oblast over a 10-year period (1947- 1957)." p. 116

Dagestan Soveshchaniye po parazitologicheskim problemam i prirodnoochagovym boleznyam. 22-29 Oktyabrya 1959 g. (Tenth Conference on Parasitological Problems and Diseases with Natural Foci 22-29 October 1959), Moscow-Leningrad, 1959, Academy of Medical Sciences USSR and Academy of Sciences USSR, No. 1 254pp.

Oblast Sanitary-Epidemiological Station/ Yaroslav'

POPKOVA, N.F. [deceased]; RYLOVA, L.I.; BEKLEMISHEVA, Ye.D.; SHORSHER, S.B.; SHKREBKO, V.L.; POKROVSKAYA, Ye. A.

Characteristics of dysentery caused by Stutzer-Schmitz shigella. Zhur. mikrobiol., epid. i immun. 43 no. 1:31-33 Ja '66 (MIRA 19:1)

1. Yaroslavskiy meditsinskiy institut, Rybinskaya gorodskaya i Yaroslavskaya oblastnaya sanitarno-epidemiologicheskiye stantsii. Submitted January 4, 1965.

SHORSHIKOVA, A.

Build more athletic facilities. Sel'.stroi. 15 no.6:6-9 Je '60. (MIRA 13:8)

1. Instruktor po stroitel'stvu sportivnykh sooruzheniy tsentral'nogo soveta Dobrovol'nogo sel'skogo sportivnogo obshchestva "Urozhay."
(Physical education facilities)

SHORSHNEV, V.I., aspirant

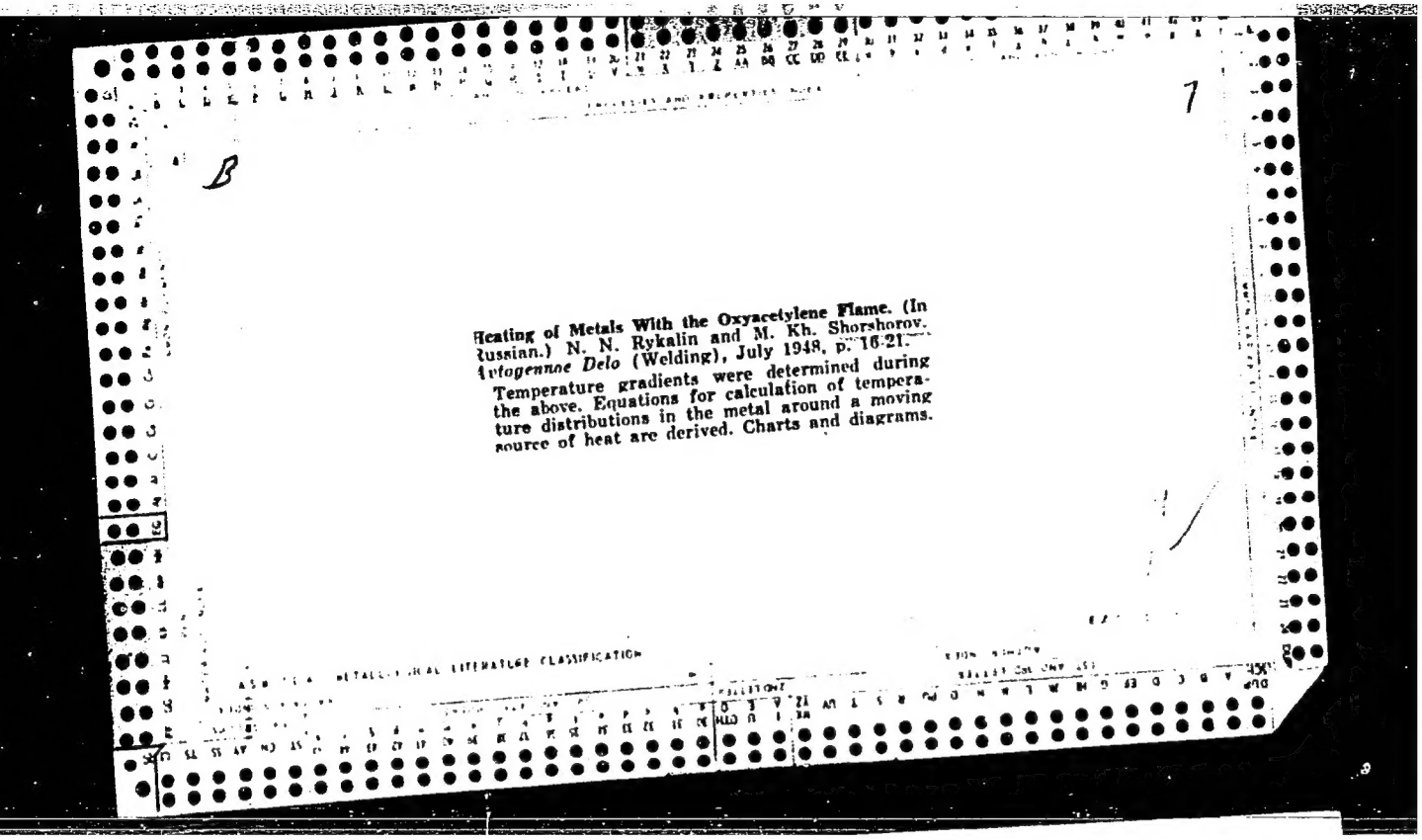
Allergic reaction in chickens kept on peat litter.
Veterinariia 41 no.11:40-41 N '64. (MIRA 18:11)

1. Leningradskiy nauchno-issledovatel'skiy veterinarnyy institut.

SHORSHNEV, V.I., aspirant; ZHURNAKOVA, M.A., doktor veter. nauk, nauchnyy rukovoditel'

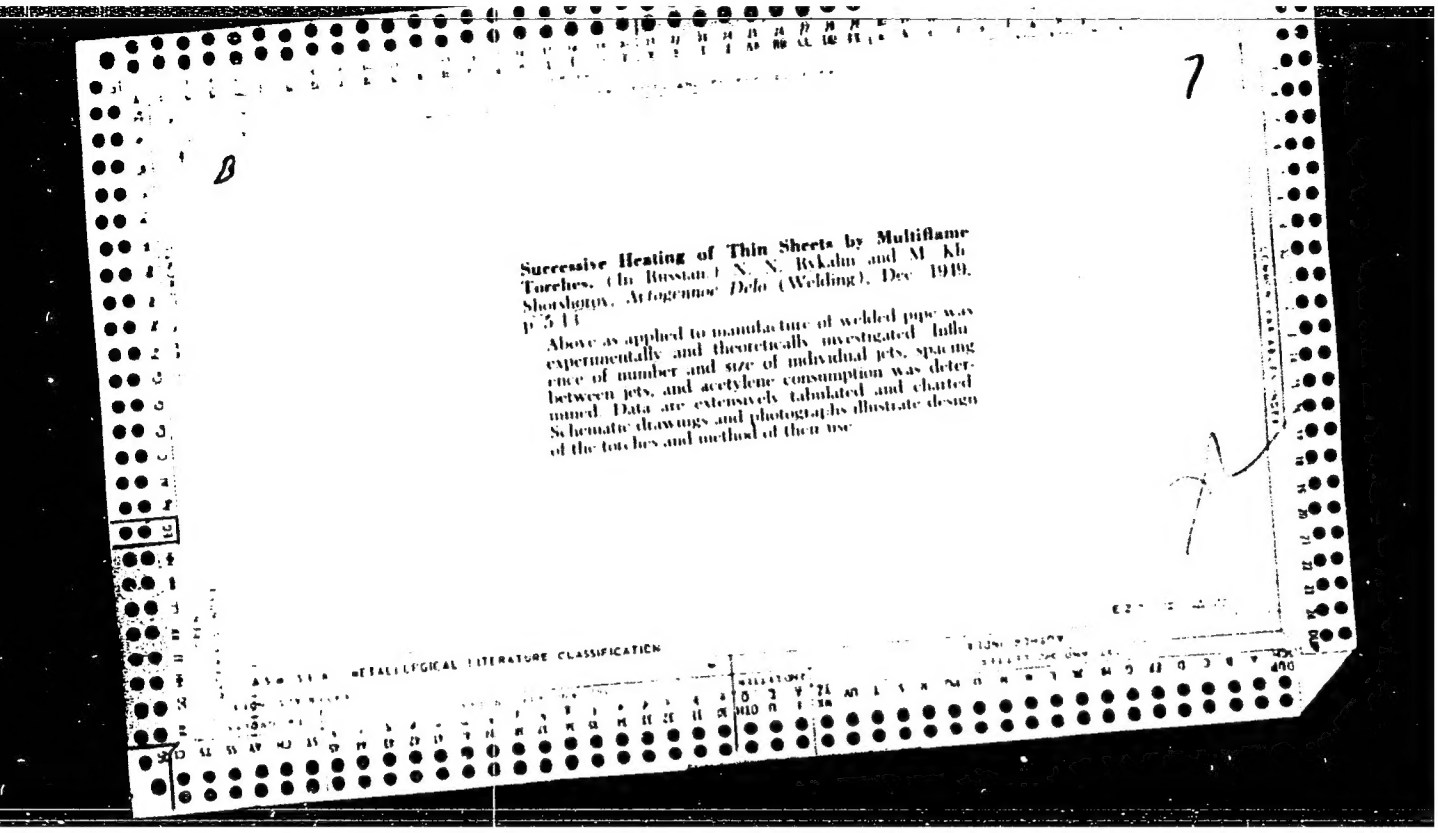
Studying acid-resistant bacteria isolated from unused peat litter. Veterinariia 42 no.10:41-43 O '65. (MIRA 18:10)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut po boleznyam ptits.



Heating of Metals With the Oxyacetylene Flame. (In Russian.) N. N. Rykalin and M. Kh. Shorshorov. *Avtogennoe Delo* (Welding), July 1948, p. 16-21.

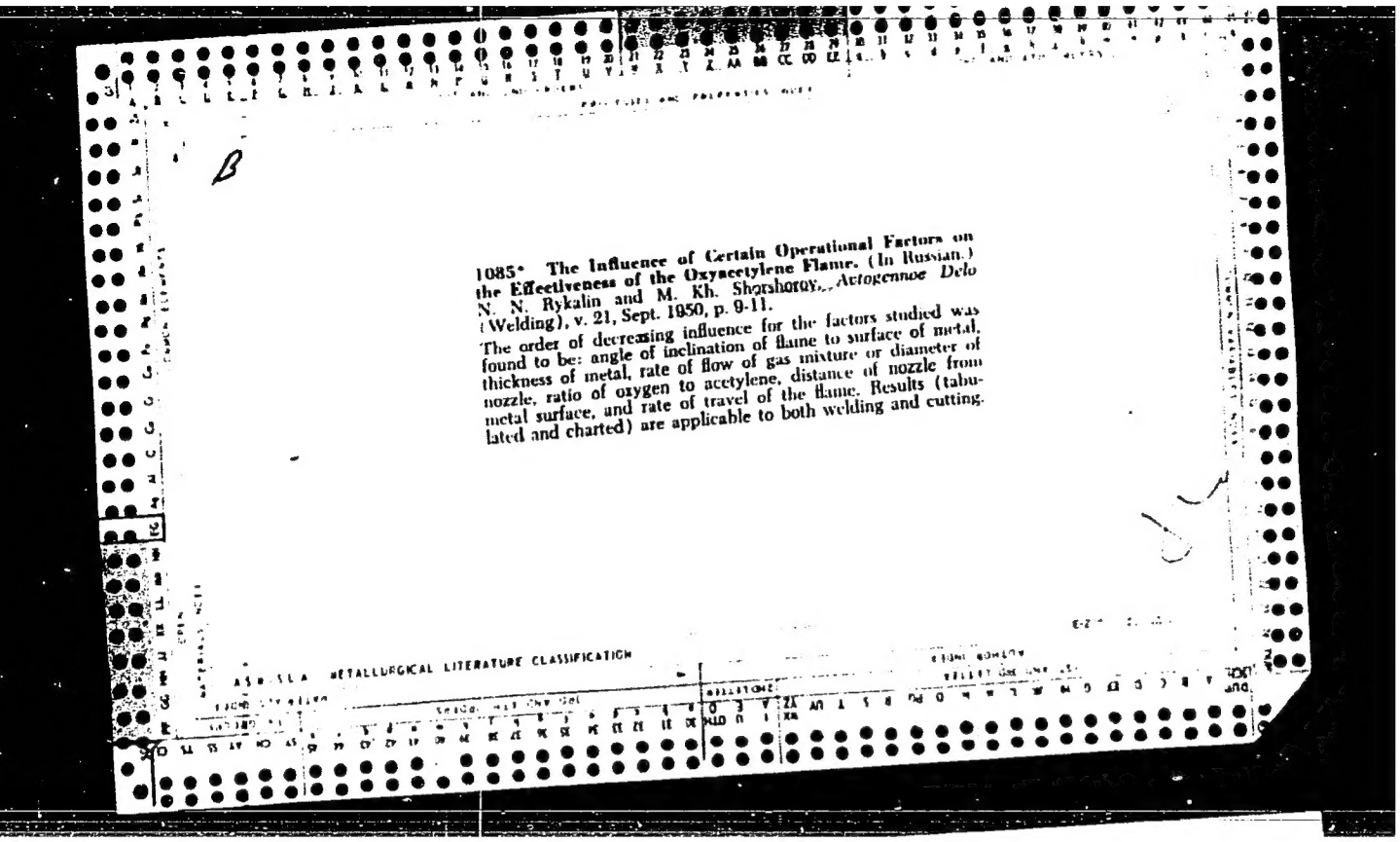
Temperature gradients were determined during the above. Equations for calculation of temperature distributions in the metal around a moving source of heat are derived. Charts and diagrams.



Successive Heating of Thin Sheets by Multiflame Torches. (In Russian.) N. N. Rykalin and M. Kh. Shorshorov. *Avtogennoe Delo* (Welding), Dec 1949, p 5-11

Above as applied to manufacture of welded pipe was experimentally and theoretically investigated. Influence of number and size of individual jets, spacing between jets, and acetylene consumption was determined. Data are extensively tabulated and charted. Schematic drawings and photographs illustrate design of the torches and method of their use.

METALLURGICAL LITERATURE CLASSIFICATION



1085* **The Influence of Certain Operational Factors on the Effectiveness of the Oxyacetylene Flame.** (In Russian.) N. N. Rykalin and M. Kh. Shorshorov. *Avtogennoe Delo* (Welding), v. 21, Sept. 1950, p. 9-11.

The order of decreasing influence for the factors studied was found to be: angle of inclination of flame to surface of metal, thickness of metal, rate of flow of gas mixture or diameter of nozzle, ratio of oxygen to acetylene, distance of nozzle from metal surface, and rate of travel of the flame. Results (tabulated and charted) are applicable to both welding and cutting.

SHORSHOROV, M. KH.

USSR/Metals - Steel, Welding, Processes Feb 52

"Distribution of the Heat Flow of a Welding Flame and Its Effect on Crack Formation in Heating Thin Sheets of 30 KhGS Steel," Prof N. N. Rykalin, Dr Tech Sci, M. Kh. Shorshorov, Cand Tech Sci

"Avtogen Delo" No 2, pp 3-7

Presents results of investigation by Sec for Sci Development of Problems of Elec Welding and Electrothermy, Acad Sci USSR, to det effect of character of heat flow distribution along surface of metal on temp field of limiting state and on formation of

212T84

cracks. Discusses inclination angle and movement direction of flame. Cromansil specimens 1 mm thick were used in expts. Suggests means for decreasing crack formation.

212T84

SHORSHOROV, M. Kh.

USSR/Metallurgy - Welding, Heating Jun 52

"Butt Heating of Bars With Stationary Flame of Multiserial Torches," Prof N. N. Rykalin, Dr Tech Sci, M. Kh. Shorshorov, Cand Tech Sci, Section of Elec Welding and Electrothermy, Acad Sci USSR

"Avtogen Delo" No 6, pp 1-6

Discusses results of expts for heating steel bars and gives methods for calg process of metal heating and cooling. Butt heating is used in pressure gas welding of bar-type articles and thick-walled pipes, and also for surface hardening. Burner concentrates heat on required surface of workpiece and permits uniform and rapid-heating

232T70

of this surface. Productivity of welding is greater than in case of side heating.

232T70

Dec 52

SHORSHOROV, M. KH.

USSR/Metallurgy - Welding. Processes

"Efficiency of the Process of Fusing With Oxyacetylene Flame," M. Kh. Shorshorov, Cand Tech Sci, Section of Electric Welding and Electrothermy, Acad Sci USSR

Avtogen Delo, No 12, pp 1-6

Studies process of fusing metal plates with flame of single- and multiple-jet torches. Discusses factors affecting efficiency and thermal effectiveness of process: acetylene consumption, angle of flame inclination in practical range, thickness of metal in 1-20 range, average flow rate of gas mixt in limits of stable burning, kind of metal or its thermophys properties.

266T38

RYKALIN, N.N.; SHORSHOROV, M.Kh.

Heating thin metallic sheets and heavy products with the flame of a simple torch. Trudy Sektsii po nauchnoi razrabotke problem elektrosvarki i elektrotermii Akademii nauk SSSR, no.2:89-111 '53. (MLRA 7:6)
(Welding)

SHORSHOROV, M.Kh.

Productivity and thermal efficiency of the processes of heating and fusing metallic sheets with the flame of an ordinary and a line torch. Trudy Sektsii po nauchnoi razrabotke problem elektrosvarki i elektrotermii Akademii nauk SSSR, no.2:112-139 '53. (MLRA 7:6)
(Welding)

1. SHORSHOROV, M.KH.

2. USSR (600)

4. Hydraulic Engineering - Kuybyshev

7. Scientific-technical conference at the Kuybyshev hydrotechnical construction project, Avtog.delo 24 no. 4, 1953.

9. Monthly List of Russian Accessions, Library of Congress, APRIL 1953, Uncl.

1. KULAGIN, I.D.; SHORSHOROV, M.Kh.

2. USSR (600)

4. Electric Welding

7. Automatic and manual arc welding of the joints of reinforcement rods in copper forms, I.D. Kulagin, M.Kh.Shorshorov, Avtog.delo 24 no. 4, 1953.

9. Monthly List of Russian Accessions, Library of Congress, APRIL 1953, Uncl.

GUSHCHINA, L.S. (Moskva); KLEBANOV, G.N. (Moskva); SHORSHOROV, M.Kh. (Moskva).

Changes in the structure and mechanical properties of low-alloy steel near the seam line caused by fusion welding. Izv.AN SSSR Otd.tekh. nauk no.8:131-134 Ag '56. (MLRA 9:9)

1.Institut metallurgii imeni A.A. Baykova AN SSSR.
(Steel alloys--Welding)

AID P - 5265

Subject : USSR/Engineering

Card 1/1 Pub. 107-a - 1/18

Authors : Shorshorov, M. Kh., Kand. of Tech. Sci., G. N. Klebanov, Eng., and L. S. Gushchina, Eng. (Institute of Metallurgy im. A. A. Baykov, Academy of Sciences, USSR).

Title : Formation of grain and changes in structure and mechanical properties of low-alloyed steel in adjacent-to-seam area.

Periodical : Svar. proizv., 9, 1-4, S 1956

Abstract : A study of causes and conditions of possible local failures in welded metal and a new method for the appraisal of weldability of metals are described. The characteristics of grain development and decomposition of austenite in welded alloyed steels are included. Two drawings, 8 graphs; 1 Russian reference (1951).

Institution : As above

Submitted : No date

SHORSHOROV, M. KH.

137-58-3-5170

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 3, p 100 (USSR)

AUTHORS: Shorshorov, M. Kh., Klebanov, G. N.

TITLE: Methods and Apparatus Employed for Investigation of Changes Occurring in Structure and Mechanical Properties of the Heat-affected Zone in the Course of the Thermal Cycle of Welding (Metod i apparatura dlya issledovaniya izmeneniy struktury i mekhanicheskikh svoystv zony termicheskogo vliyaniya v usloviyakh termicheskogo tsikla svarki)

PERIODICAL: Tr. In-ta metallurgii, AN SSSR, 1957, Nr 1, pp 199-210

ABSTRACT: A report on methods and equipment developed for the purposes of studying the structural and mechanical property changes occurring in the parent metal in the thermal cycle (TC) of welding. Thin, rod-like specimens are heated by the passage of an electric current, and are then cooled in accordance with the given TC of welding. The heating of the specimens is controlled by varying the current according to a given schedule, while the cooling is accomplished by gas blowing, spraying with water, or with the aid of passing low-amperage currents through the specimen. In studies of the kinetics

Card 1/3

Methods and Apparatus Employed for (cont.)

the differential equation for the caloric balance of the heating of a conductor due to the passage of a current. A tensile strength testing machine, employing an electromagnetic system powered by a 60-v direct current, is capable of exerting forces up to 1200 kg, and can produce high deformation speeds in the metal. Thus it is possible to accomplish fracture of the specimen within 0.05 seconds or less, i. e., under conditions in which the temperature of the TC of welding varies very slightly, even at high heating and cooling rates. This method will permit the determination of σ_b and σ_s of the metal of the specimen under conditions of high-speed elongation. σ_b and σ_s are determined directly from the graphs, while ψ is computed from measurements of the neck taken in the central portion of the cut-out in the specimen before and after elongation. A 6 mm cut-out with a uniform temperature distribution is taken as the basis of the computation of δ. By way of an illustration the authors show the changes in the mechanical properties of 35KhGSA steel, which occur near the seam during the TC of a single-pass butt welding of 35mm thick sheets at an energy input of 20,000 cal/cm.

G.K.

Card 3/3

TITLE: Weldability of Titanium (Issledovaniye svarivayemosti titana).

gation processes is described in detail.

The conclusions reached are the following:

1) The most difficult problem in welding titanium is the deterioration of mechanical properties in the metal at the zone of fusion.
2) The changing of σ_b, σ_s, and ψ in weld joints according to the temperature is of the same nature as in the base metal.
3) Intensive grain growth in the weld metal and in the adjacent parent metal is observed during welding.
4) The formability of weld joints in # 2 of titanium grades "ИМП-А" and "ВТ-1А" was very high and satisfied the production requirements.
5) The structure and the mechanical properties of low-temperature α-phase base metal are changing abruptly in the heating-part as well as in the cooling-part of the heat cycle; in the temperature interval of β-phase, σ_b and ψ are changing only insignificantly. After the thermal cycle of heating and cooling, titanium of all grades possesses lower mechanical properties.
6) For comparing the gas contents of the base metal, a special test is recommended, based on heating thin samples to 1300-1500° at

Card 2/3

TITLE: Weldability of Titanium (Issledovaniye svarivayemosti titana).

different speeds. The criterion for evaluation in this test is the critical heating speed at which formation of bulges and pores is observed on the metal.

7) The choice of welding technology is based on keeping the metal a short time in the β-phase temperature of intensive grain growth, and on slowing down the cooling in the interval of $\beta \rightarrow \alpha$ conversion.

The article contains 5 tables, 5 diagrams, and 15 microphotographs.

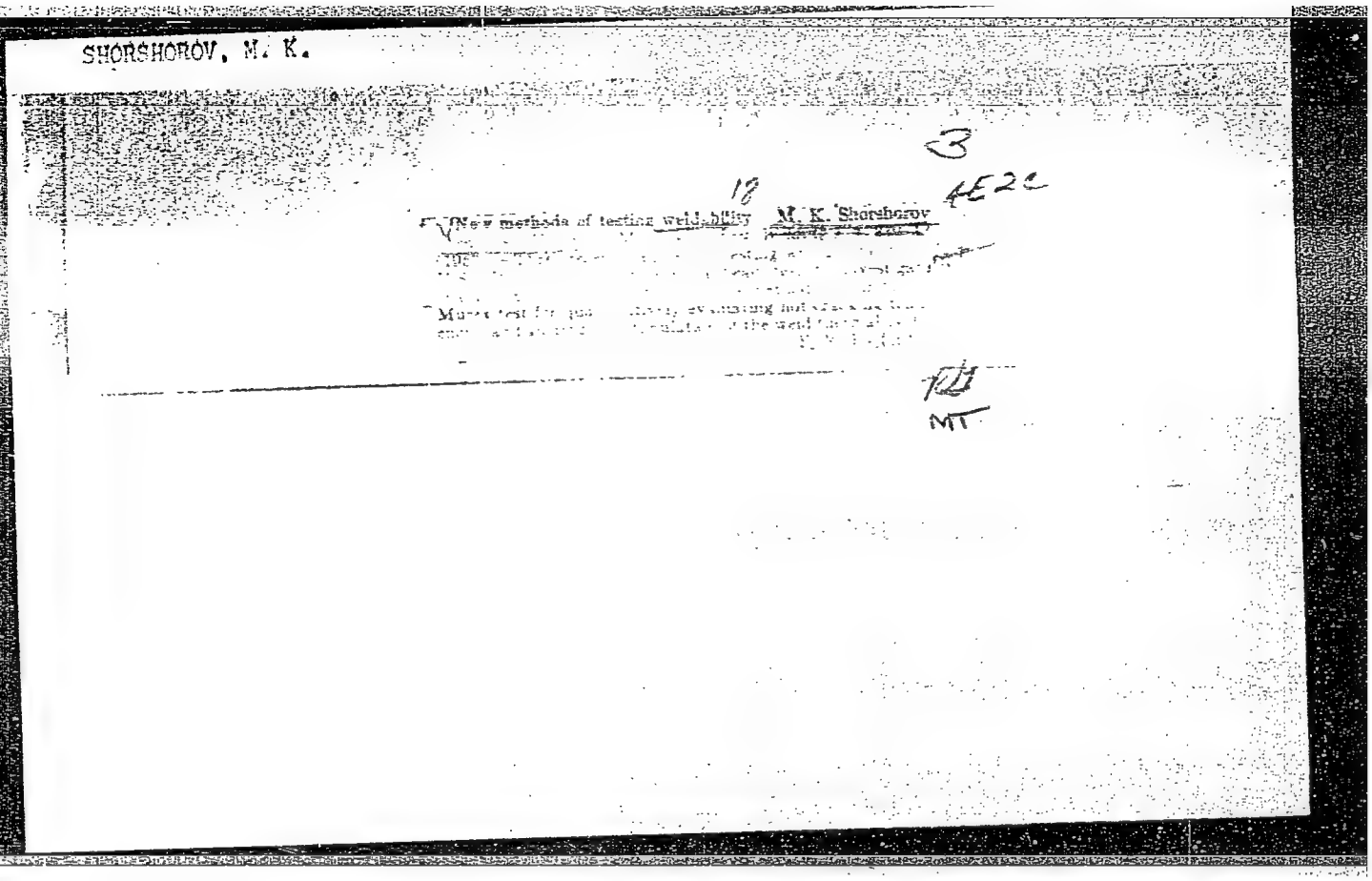
ASSOCIATION: Institut metallurgii imeni A.A. Baykova AN SSSR (Institute for Metallurgy imeni A.A. Baykov, Academy of Sciences, USSR).

PRESENTED BY:

SUBMITTED:

AVAILABLE: At the Library of Congress.

Card 3/3



SHORSHOROV, M. K.

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M. K. Shorshorov

MT

SHORSHEROV, M.KH.

135-9-22/24

AUTHORS: Rykalin, N.N., and Shorsherov, M.Kh.

TITLE: Welding Technique in Great Britain (Svarochnaya tekhnika v Velikobritanii)

PERIODICAL: "Svarochnoye Proizvodstvo", 1957, # 9, p 40-44 (USSR)

ABSTRACT: The authors visited Britain in October-November 1956 on invitation by the British Welding Association and the West-Scotland Iron and Steel Institute. The article presents a report on this visit during which the authors got information on the activities of the British Welding Research Association and visited the Cambridge and the Birmingham Universities and six machinebuilding plants, and delivered reports on Soviet welding technique at two meetings in London. The report deals with organization of British technical education, equipment of university laboratories, and gives names of professors. The number of welding engineers trained in Britain is obviously too small, and according to British statistics, the Soviet Union has 230 engineers per one million inhabitants, USA - 130, and Britain - 18. The welding equipment and production of the six visited plants is described and the names of leading engineers are mentioned. In conclusion, the authors say that their incomplete impressions

Card 1/2

Welding Technique in Great Britain

cannot fully characterize the British welding industry, and express their gratitude to British scientists and engineers who contributed to creation of business-like and friendly relations with the Soviet specialists.
The article contains 8 photographs.

AVAILABLE: Library of Congress

Card 2/2

Shorshorov, M. Kh.

AUTHORS: Rykalin, N. N. and Shorshorov, M. Kh. (Moscow). 24-10-9/26

TITLE: Welding science in Great Britain. (Nauka o svarke v Velikobritanii)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1957, No.10, pp.61-67 (USSR)

ABSTRACT: The authors were invited to visit Great Britain in October-November, 1956 and participated in a symposium on welding of low alloy steels for boilers and high pressure vessels in Glasgow and at the annual conference of the British Welding Institute in London. They report very exhaustively on the available research facilities in Great Britain and comment on these as well as on the teaching establishments, comparing conditions in Britain with conditions in the Soviet Union. Discussing the teaching, particularly at Cambridge and Birmingham Universities, the authors mention that the dissertations which they have seen there relate to a relatively narrow range of problems and, although they are well prepared and supported by extensive experiments, they do not have a wide scope. Comparing the Soviet "ordinary candidate dissertation" with those dissertations which the authors had the opportunity of seeing in Britain, they consider

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Welding science in Great Britain. 24-10-9/26

the Soviet ones as being superior. The Soviet post-graduate who defends his dissertation successfully gets the modest title "Candidate of Sciences", whilst in Britain a person with equal qualifications gets the degree of Doctor of Philosophy; the Soviet degree "Doctor of Technical Sciences" corresponds in England to the "Doctor of Science, Engineering". The number of graduate engineers per one million of inhabitants is 230 in the Soviet Union, 130 in the U.S.A. and 18 in Britain. The authors of this report read papers on October 24, 1956 at a meeting convened jointly by the British Institute of Welding and the British Welding Association, which were published in Britain in 1957. Particularly, information on electric slag welding aroused great interest, since this technique is almost unknown in the West. At a seminary in London on October 25 and October 31, 1956 one of the authors reported at the Welding Research Association on Soviet research relating to thermal processes during welding and here he outlines work in progress in Britain in this field. British research is also briefly reviewed in the following fields: low and medium alloy

Card 2/4 steels for welded high pressure vessels; methods of

Welding science in Great Britain. 24-10-9/26

evaluation of the tendency of steel to brittle fracture; problems of cold crack formation; methods of evaluation of the tendency to hot cracking of the basic and of the deposited metal during welding and application of welding in engineering. The authors summarise their impression thus: arc welding of stainless steel is extensively developed, particularly welding of aluminium in protective atmospheres, i.e. argon, helium and carbon dioxide (Quasi-Arc, Metropolitan Vickers, British Oxygen, Welding Research Institute, Birmingham University); the efficient process of electro-slag welding is almost not being used at all in British industry; a series of special automatic machines have been developed for arc welding under flux and inside protective atmospheres, for instance, for welding longitudinal seams in tubes, for welding commutators of electric motors (Metropolitan Vickers, Quasi-Arc); various manipulators and assembly-welding jigs are being produced by a number of specialised firms; small undertakings producing electrodes for arc welding are extremely well organised (Rockweld, producing up to 6000 tons per annum), the basic operations are highly mechanised, the personnel is very well utilised (good

Card 3/4

Shorshorov, M.Kh.

135-12-1/17

AUTHOR: Shorshorov, M.Kh., Candidate of Technical Sciences, and Kodolov, V.D., Engineer

TITLE: The Changing of Properties of Low-alloy and Carbon Steel of the Perlite Class in Arc Welding (Izmeneniye svoystv nizko-legirovannykh i uglerodistykh staley perlitnogo klassa pri dugovoy svarke)

PERIODICAL: Svarochnoye Proizvodstvo, 1957, # 12, p 1-5 (USSR)

ABSTRACT: The described experiments were performed with the purpose of finding the optimum "linear energy" of the arc (q/v in calories per cm) and the optimum cooling rate. The optimum welding technology was determined for medium thickness of steel grades "35 ХГСА", "45", "40 Х", "20 ХГС","23 Г","25 НЭ"and "12 Н2"on modified Čabelka specimens. The information includes the chemical composition of investigated steel grades and a detailed description of the preliminary heat treatment and the welding technology used, the drawings of specimens, the essence of the Čabelka test. N.N. Rykalin's theory of heat propagation in the welding process (Ref. 1) is mentioned in connection with the "bead specimen" (valikovaya proba) test method, which was

Card 1/2

SHORSHOROV, M. Kh.; AMFITEATROVA, T. A., and NAZAROV, G. V.,

"Weldability of IMP-1 Titanium," Titan i yego splavy; metallurgiya i metallovedeniye (Titanium and Its Alloys; Metallurgy and Physical Metallurgy), Moscow, Izd-vo AN SSSR, 1958. p 180.

Institute of Metallurgy, USSR Academy of Sciences

SHORSHOROV, M. Kh.

18(2) PHASE II - ABSTRACTS AB-1

Akademiya nauk SSSR. Institut metallurgii

Titan i yego splavy; metallurgiya i metallovedeniye (Titanium and Its Alloys; Metallurgy and Physical Metallurgy) Moscow, Izd-vo AN SSSR, 1958. 209 p. 4,000 copies printed.

Resp. Ed.: N.V. Ageyev, Corresponding Member, USSR Academy of Sciences; Ed. of Publishing House: V.S. Rzhesnikov; Tech. Ed.: A.A. Kiseleva.

INTRODUCTION: This book, of which a Phase I Exploitation (SOV/1200) has been prepared, is a collection of scientific papers devoted to the study of titanium and its alloys from three main points of view: physical metallurgy, forming, and welding. Special problems investigated include structural changes occurring during welding, determination of the content of harmful gases, development of industrial methods of rolling, and oxidation at various temperatures.

PART I. PHYSICAL METALLURGY

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PART III. WELDING OF TITANIUM

Shorshorov, M.Kh., T.A. Amfiteatrova, and G.V. Nazarov (Institute of Metallurgy, USSR Academy of Sciences) Weldability of IMP-1 Titanium 180

IMP-1 titanium plates (100 x 40 x 2 mm) were butt-welded in a protective atmosphere (argon and helium), the added metal having the same chemical composition as the parent metal (typical analysis: 0.05 percent C, 0.3 percent Fe, 0.05 percent Si, 0,21 percent Ni, 0.08 percent N_2, 0.03 percent Cr, 0.3-0.6 percent O_2). Investigations were made of the following; mechanical properties of the weld metal; grain growth and changes in structure and mechanical properties of the heat-affected zone under various thermal conditions; and swelling of titanium on being heated. In the latter connection a test was developed for the comparative determination of the degree of saturation of the metal with hydrogen. Conclusions. (1) The main difficulties in developing the technological processes of welding titanium are connected with the deterioration of the properties of the

base metal in the heat-affected zone. (2) Changes in tensile strength and reduction in area as functions of temperature have the same character as in the case of the base metal. (3) Intensive grain growth is observed in the weld metal and heat-affected zones. The beta-phase grain growth in the dendrites of heating is more intensive than in the dendrites of cooling. (4) The structure and mechanical properties of rolled base metal having the alpha-phase structure change sharply with change in temperature, both in the dendrites of heating and cooling. In the beta-phase temperature range, tensile strength, elongation, and reduction in area change very little. Titanium in the rolled state, even in the alpha-phase, shows greater tensile strength, elongation, and reduction in area than titanium which has not been subjected to the heat of welding. (5) In the test for comparative determination of hydrogen saturation, thin specimens are heated to 1300-1400° C at various speeds. The criterion of quality is the critical rate of heating at which swelling of the metal takes place and porosity develops. (6) For improving the properties and structure of welded titanium joints in the heat-affected zone, welding methods and conditions should be selected with a view to reducing the time during which the metal is at a temperature where the beta-phase

grain growth is intensive and to decreasing the cooling rate in the $\beta \rightarrow \alpha$ transformation temperature range. There are 12 figures, 2 tables, and 2 references (both Soviet).

Poplavko, M.V., N.N. Manuylov, and L.A. Gruzdeva (Ministry of the Aircraft Industry of the USSR) Some Problems in the Welding and Soldering of Commercial Titanium 194

VT-1D commercial titanium, which has a one-phase (alpha) structure, was investigated for weldability. Tests were performed on sheet metal rolled from ingots that were produced in an arc furnace with a nonmelting tungsten electrode. Conclusions. (1) VT-1D titanium sheet metal, when its properties are stable and its plasticity sufficiently high, exhibits good weldability characteristics in the following types of welding: argon-shielded arc welding (manual and automatic), spot welding, seam welding, and butt welding. (2) In order to produce welded joints with good properties, it is necessary to remove, before welding, any scale present on the surface as well as the surface layer of metal itself, if it is contaminated with gases (oxygen, hydrogen, nitrogen). These layers can be successfully removed by pickling in an acid medium. Scale removal can be facilitated

SHORSHOROV, M.Kh.; AMFITEATROVA, T.A.; NAZAROV, G.V.

Weldability of IMPl titanium. Titan i ege splavy no. 1:180-193 '58. (MIRA 14:5)

1. Institut metallurgii AN SSSR.
(Titanium—Welding)

SOV-135-58-9/19

AUTHOR: Ghorshorov, M.Kh., Candidate of Technical Sciences and Nazarov, G.V., Engineer

TITLE: The Effect of Some Alloying Elements on the Properties of Weld Joints of Titanium and Its Alloys (Vliyaniye nekotorykh legiruyushchikh elementov na svoystva svarnykh soyedineniy titana i yego splavov)

PERIODICAL: Svarochnoye proizvodstvo, 1958, Nr 3, pp 30-33 (USSR)

ABSTRACT: Investigations on the weldability of "IMP-1A" and "VT-1D" commercial titanium and its alloys with aluminum, lead, manganese, vanadium, tungsten, etc. were carried out by G.V. Nazarov at the laboratory for metal welding of the Institute of Metallurgy imeni Baykov together with TsNIIChermet. It is concluded that the optimum cooling rate in the β-α range (Tables 1 and 4) must be considered in selecting the welding process technology. Elements reducing the plasticity of weld seams are classified in the following order: Fe, Mn, V, Sn, Al. Recommendations are given for obtaining titanium alloys which do not require heat treatment after welding, and for obtaining the best plastic properties of weld joints by the use of heat treatment.

Card 1/2

SOV-135-58-9/19

The Effect of Some Alloying Elements on the Properties of Weld Joints of Titanium and Its Alloys

There are 4 tables, 3 photos, 2 graphs, and 2 Soviet references.

ASSOCIATION: Institut metallurgii imeni A.A. Baykova AN SSSR (Institute of Metallurgy imeni A.A. Baykov, AS USSR)

1. Welded joints--Properties 2. Titanium--Welding 3. Titanium alloys--Welding

Card 2/2

TYUL'YAKOV, F. Ya. and SKORSHOROV, M. Kh. (Candidates of Technical Sciences)
GORYATCHEV, A.P. and FOLYAKOV, D. A. (engineers)

"Welding of Titanium,"

paper presented at All-Union Scientific-Technical Conference on Welding in Shielding Gases, Leningrad, Dec 1957.

(Svarochnoye Proizvodstvo, 1958, No. 4, pp 46-47 - author Tyul'kov, M. D.)

AUTHOR: Gulyayev, B.B. SOV/24-58-4-37/39

TITLE: Conference on Crystallisation of Metals (Soveshchaniye po kristallizatsii metallov)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, 1958, Nr 4, pp 153 - 155 (USSR)

ABSTRACT: This conference was held at the Institut mashinovedeniya AN SSSR (Institute of Mechanical Engineering of the Ac.Sc. USSR) on June 28-31, 1958. About 400 people participated and the participants included specialists in the fields of foundry, metallurgy, crystallography, physics, welding, heat, physical chemistry, mathematical physics and other related subjects. In addition to Soviet participants, foreign visitors included Professor D. Czikl (East Germany) and N.I. Chvorinov (Czechoslovakia). This conference on crystallisation of metals was the fourth conference relating to the general problem of the theory of foundry processes.

Crystallisation of Non-ferrous Metals. N.N. Belousov and A.A. Dodonov - in their paper "Investigation of the Crystallisation and the Properties of Non-ferrous Metals Under Conditions of Applying Pressure", presented results of experiments on producing castings which crystallise under pressure from all sides and piston pressure within a wide range of specific loads. The results of the investigation provide material for improving existing methods of applying pressure to influence the crystallisation of alloys. The influence of the conditions of crystallisation on the casting and mechanical properties of aluminium alloys, at normal and at elevated temperatures, were discussed in the papers of I.F. Kolobnev and A.Ye. Semenov. The results of investigations of the conditions of crystallisation of aluminium alloys during continuous casting were presented in the paper of Ye.D. Zakharov. N.L. Pokrovskiy and D.Ye. Ovsiyenko dealt with the features of crystallisation of various

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non-ferrous alloys and the physico-chemical phenomena accompanying this process.

Crystallisation of Metals in the Welding Bath. The following papers were read: B.A. Movchan - "Investigation of the Features of the Microscopic Chemical Non-uniformity in Alloys"; G.L. Petrov - "Crystallisation and Chemical Non-uniformity in Weld Joints"; M.Kh. Shorshorov and V.S. Sedykh - "Influence of Non-uniformities of Crystallisation in the Weld Bath on the Formation of Hot Cracks".

Crystallisation of Metals in an Ultrasonics Field. The following papers were read: Member of the Ac.Sc. Belorussian SSR N.N. Sirota, Ye.L. Lekhtblad and N.N. Smolyarenko - "Crystallisation of Metals and Alloys in an Ultrasonics Field"; I.I. Teumin - "Influence of Elastic Oscillations on the Processes of Crystallisation and the technological properties of Alloys"; L.L. Silin and A.A. Yerokhin - "Effect of Ultrasonics on Crystallising Metal in the Weld Bath".

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135-58-6-7/19

AUTHORS: Shorshorov, M.Kh., Candidate of Technical Sciences, and Katkhanov, V.N., Engineer

TITLE: Investigation of Weldability and Development of Multilayer Welding Technology for Heat-resistant Pearlite Steel Rotor (Issledovaniye svarivayemosti i razrabotka tekhnologii mnogosloynoy svarki rotora iz teploustoychivoy perlitnoy stali)

PERIODICAL: Svarochnoye Proizvodstvo, 1958, Nr 6, pp 18-23 (USSR)

ABSTRACT: Weldability of heat resistant steel "EI415" and "30KhM" was studied jointly at the authors' institute with the Welding Department of TsNIITMASh. The "IMet-1" method /Ref. 1/ was used, which makes it possible to find the permissible cooling rate in the base metal zone adjacent to the weld seam, i.e. a cooling rate that assures good mechanical properties and crystalline structure excluding the forming of cold cracks at welding. The composition of the two investigated steel grades and of the weld metal produced by electrodes "LKZ-70M" is given. The observations made in experiments are described and illustrated by graphs and micro-photographs. The permissible cooling rate of weld-adjacent zone was found

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135-58-6-7/19

Investigation of Weldability and Development of Multilayer Welding Technology for Heat-resistant Pearlite Steel Rotor

to be 25°C/sec for steel "EI415" and 8°C/sec for steel "30KhM". The article includes calculations, based on the permissible cooling rate, which were applied in developing the technology of manual multi-layer welding. The developed welding technology for a model of steel "EI415" used in a turbine rotor neck of 205 mm diameter and 40 mm thickness, is described in detail. Temperatures of 660-680°C are recommended for annealing after welding. Chief of the TsNIITMASh Welding Department, L.M. Yarovinskiy; Chief of the Leningrad imeni Kirov Plant's Welding Department, S.K. Zvegintsev; and Engineer I.A. Zaks; participated in the work. There are 9 figures, 6 tables and 5 Soviet references.

ASSOCIATION: Institut metallurgii imeni Baykova AN SSSR (Metallurgic Institute imeni Baykov AS USSR)

AVAILABLE: Library of Congress

Card 2/2

135-58-8-3/20

AUTHORS: Shorshorov, M. Kh., Candidate of Technical Sciences, and Sedykh, V. S., Engineer

TITLE: On the Evaluation of Proneness to Hot Cracks of Welded Metal in the Welding Process (Ob otsenke sklonnosti metalla shvov k obrazovaniyu goryachikh treshchin pri svarke)

PERIODICAL: Svarochnoye proizvodstvo, 1958, Nr 8, pp 10 - 14 (USSR)

ABSTRACT: Detailed information is presented on a method and machine ("IMET-11") used to investigate the kinetics of the formation and expansion of cracks in metal during the welding process. It was stated that crack formation is caused by non-simultaneous crystallization of the weld metal and by the existence of temperature interval of brittleness. Development of hot cracks was observed in weld portions adjacent to base metal zones where the heat emission was most intensive. In welding "St.3" steel with "UONI-13/45" electrodes with "EI582" rods, hot cracks developed at a temperature interval of 1420 - 1300°C and most easily at 1320 - 1350°C which corresponds to the minimum degree of plasticity of the crystallizing metal. Comparative eval-

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135-58-8-3/20

On the Evaluation of Proneness to Hot Cracks of Welded Metal in the Welding Process

uations of metal proneness to crack formation in welding low-carbon and austenitic steels with different grades of electrodes were obtained. There are 3 diagrams, 1 photo, 1 graph, 1 table and 7 references 4 of which are Soviet and 3 English.

ASSOCIATION: Institut metallurgii imeni A. A. Baykova AN SSSR (Institute of Metallurgy imeni A. A. Baykov, AS USSR)

1. Steels--Welding 2. Welds--Fracture--Test methods
3. Electrodes--Applications

Card 2/2

SOV-135-58-10-5/19

AUTHORS: Russiyan, A.V., Engineer, and Shorshorov, M.Kh., Candidate of Technical Sciences

TITLE: The Effect of Boron on the Tendency of Heat-Resistant Austenitic "1Kh13N18V2B" Steel to Hot Crack Formation in Welding Process (Vliyaniye bora na sklonnost' zharoprochnykh austenitnykh staley tipa "1Kh13N18V2B" k obrazovaniyu goryachikh treshchin pri svarke)

PERIODICAL: Svarochnoye proizvodstvo, 1958, Nr 10, pp 14 - 18 (USSR)

ABSTRACT: Experimental investigations were carried out by the authors at the welding laboratories of both the Institute of Metallurgy imeni A.A. Baykov AS USSR and TsNIIChermet, on the effect of boron on the proneness to hot crack formation of "1Kh13N18V2B" steel in arc welding and on the possibility of controlling the resistance to hot cracks by using different fluxes of standard grades and electrode rods, having the same composition as the base metal. It was stated that a boron content from 0 up to 0,015% reduces the temperature of the sharp reduction of plasticity in zones adjacent to seams from 1,150 to 1,010°C and expands the temperature interval of brittleness. The flux composition has a substantial effect on the tendency to hot cracks. Best results

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SOV-135-58-10-5/19

The Effect of Boron on the Tendency of Heat-Resistant Austenitic "1Kh13-N18V2B" Steel to Hot Crack Formation in Welding Process

were obtained in welding with "AN-26" flux, where a noticeable reduction of metal resistance to hot cracks occurred only if the boron content exceeded 0.005%. Highest passage of boron into metal is ensured by the use of "BKF-1", "AN-30" and "AN-26" fluxes. There are 3 tables, 1 graph, 2 diagrams, 2 sets of photos and 4 Soviet references.

ASSOCIATION: TsNII Chermet (1st author)
/Institut metallurgii imeni A.A. Baykova, AN SSSR
Institute of Metallurgy imeni A.A. Baykov, AS. USSR)
(2nd author)

1. Steel--Welding 2. Boron--Effectiveness 3. Welding fluxes--Applications

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PHASE I BOOK EXPLOITATION SOV/2857

Shorshorov, Minas Khachaturovich, and Gennadiy Vasil'yevich Nazarov

Svarka titana i yego splavov (Welding of Titanium and Its Alloys), Moscow, Mashgiz, 1959. 134 p. Errata slip inserted. 4,000 copies printed.

Ed.: G. B. Yevseyev, Candidate of Technical Sciences; Ed. of Publishing House: N. S. Stepanchenko; Tech. Ed.: V. D. El'kind; Managing Ed. for Literature on Heavy Machine Building (Mashgiz): S. Ya. Golovin, Engineer.

PURPOSE: This book is intended for scientists, production engineers, and designers working in the field of titanium welding and on the development of new titanium alloys for application in welding.

COVERAGE: The book deals with the weldability of titanium and its alloys and with modern industrial methods of welding and soldering them (inert-gas shielded arc welding, submerged-arc welding, electroslag welding, resistance welding, etc.). Basic data on the

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Welding of Titanium and Its Alloys SOV/2857

production and properties of titanium are given. Other matters discussed are the effect of alloy composition and harmful impurities on weldability, thermal processes in welding, control of structure and properties of welded joints, and principles of selecting welding and heat-treating regimes. The main fields of application of welded designs are indicated. The following personalities are mentioned for their contributions in this field: S. M. Gurevich, A. P. Goryachev, F. Ye. Tret'yakov, M. V. Poplavko, M. A. El'yasheva, B. D. Orlov, and Ye. A. Guseva. There are 51 references: 28 Soviet and 23 English.

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Welding of Titanium and Its Alloys SOV/2857

AVAILABLE: Library of Congress

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Card 4/4

SHORSHOROV M. Kh.

~~[illegible], G. V.~~

APPROVED FOR RELEASE: 08/09/2001 CIA-RDP86-00513R001549910010-1

18(0) PHASE I BOOK EXPLOITATION SOV/2316

Akademiya nauk SSSR. Institut nauchnoy i tekhnicheskoy informatsii

Metallurgiya SSSR, 1917-1957; [t.] II (Metallurgy in the USSR, 1917 - 1957; Vol 2) Moscow, Metallurgizdat, 1959. 813 p. Errata slip inserted. [illegible]00 copies printed.

Ed. (Title page): I. P. Bardin, Academician; Ed. (Inside book): G. V. [illegible]pova; Tech. Ed.: P. G. Islent'yeva.

PURPOSE: This book is intended for metallurgists.

COVERAGE: The articles in this collection present historical data on the achievements of Soviet metallurgy, both ferrous and nonferrous, during the period 1917-1957. Advances in theory and practical application are thoroughly discussed. Many of the articles describe the present status of individual branches of metallurgy and give an idea of what may be expected in the future. Advances made in other countries are also discussed. The articles are accompanied by a large number of references. For further coverage, see Table of Contents.

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The authors discuss the studies that have been made in the USSR of the theoretical aspects of welding, beginning in the latter part of the nineteenth century. Specific topics are: investigation of the arc,

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theory of welding deformations and stresses, calculation methods used in planning the industrial production of welded structures, and the theory of strength of welded structures.

The author discusses the following: types of phase transformations occurring during rapid heating; the magnetic theory of the kinetics of induction heating; interconnection between original structure, steel composition, and the kinetics of heating; structure of austenite formed during induction heating; transformation of austenite into martensite and tempering after high-frequency hardening; ways of improving the technology of induction heat treatment; regimes of induction hardening and application of induction heating in carburizing.

After giving a classification of the types of heat-treating processes, [illegible]

Card 6/15

SHORSHOROV, M.Kh.; NAZAROV, G.V.

Welding and soldering of titanium and its alloys. Itogi nauki: no.2:252-284 '59. (MIRA 12:9)
(Titanium--Welding)

18(5) SOV/135-59-6-3/20

AUTHOR: Russiyan, A. V., Engineer and Shorshorov, M. Kh., Candidate of Technical Sciences

TITLE: New Austenite Electrodes for Welding 1Kh13N18V2B Steel

PERIODICAL: Svarochnoye Proizvodstvo, 1959, Nr 6, pp 9-13 (USSR)

ABSTRACT: The authors give the results of the investigation of new austenite-ferrite electrodes for welding the 1Kh13N18V2B steel. The investigation was carried out by TsNIIChERMET and the Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences, USSR, during 1957-1958. There are described the methods [Ref 1, 2 and 4], used for the new invention: there has been applied the method of K. A. Lanskiy, TsNIIChERMET [Ref 6 and 7] for EI 694, EI 695 and EI 695 R steels and EI 694 and EI 695 electrodes, (Table 1). Table 2 describes the construction of the protective shield. There have been constructed electrodes which produced melted metals without fissures by IMET-II [Ref 4 and 8]. The authors discuss the influence of alloy-elements and admixtures on the tendency

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New Austenite Electrodes for Welding 1Kh13N18V2B Steel

to form heat-fissures in welded metal. There are represented the electrodes AZh 13-18 and AZh 13-15. Table 3 shows the chemical construction of the electrodes and of melted metal. Moreover, several kinds of electrodes for welding special kinds of steel are named: NIAT-5 for Kh 15 N 25 steel kind EI 395; AZh 13-15 and AZh 13-18 for Kh 13 N 15 and Kh 13 N 18 steel grade EI 694, EI 695 R, KTI-7 for Kh 15 N 35 steel grade 612. Table 4 shows the comparison of electrodes, regarding the heat fissure forming tendency. The experiments with the new electrodes and the new methods have been accomplished in the laboratories of TsNIIChERMET and the "Machine-Building Plant Ordzhonikidze", Podol'sk (Podol'skiy mashinostroitel'nyy zavod imeni Ordzhonikidze). The results were satisfactory. In Table 5 there is shown the percussive toughness of seams with many layers in metal welded by AZh 13-18 electrodes. The authors state that the new austenite-ferrite electrodes AZh 13-18 and AZh 13-15 may be used in welding steels of the type 1Kh13N18V2B (EI 695 and EI 695 R) and 1Ch13N15B

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SOV/135-59-6-3/20

New Austenite Electrodes for Welding 1Kh13N18V2B Steel

(EI 694). There are 2 diagrams, 5 tables, 3 photographs, 3 graphs and 9 references, 8 of which are Soviet and 1 German.

ASSOCIATION: Institut metallurgii imeni A. A. Baykova, AN, SSSR (Institute of Metallurgy imeni A. A. Baykov, AS, USSR) (M.Kh.Shorshorov), TsNII Chermet (A. V. Russiyan)

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SOV/135-59-9-3/23

18(5,7)
AUTHORS: Shorshorov, M. Kh., Zemzin, V. N., Candidates of Technical Sciences; Belov, V. V., and Smirnova, I. D., Engineers

TITLE: Research on Weldability of Heat Resistant Steels Containing 12% Chromium

PERIODICAL: Svarochnoye proizvodstvo, 1959, Nr 9, pp 6-10 (USSR)

ABSTRACT: The authors state that the use of higher working temperatures (565-580°C) with present day steam turbines need heat resistant steels for the more heated parts. Therefore research was done on the weldability of heat resistant steels containing about 12% chromium. Chromium steels without additional alloys (Type 2Kh13, 1Kh13, 08Kh12) and reinforced steels (Type 15Kh11MF, 15Kh11VF, 15Kh11MFB, 15KhVMF, 15Kh12VMF with Ti, Nb and B, 25Kh11M3F) were investigated. The influence of the welding on structure and qualities of the zone near the weld was investigated by the method IMET-1 [Ref 4] under conditions of arc welding with maximum temperatures. T_{max}= 1370 - 1400°C, and cooling speed W_{0kh1} = 0.1 - 600°C/sec

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Research on Weldability of Heat Resistant Steels Containing 12% Chromium

in an interval of 750 - 650°C. The change of the mechanic qualities of chromium steels under the influence of the thermal cycle of welding (Table 2) shows, that in steels without alloying addition the carbon content has a considerable influence. Fig 1 shows the change of the mechanical qualities in the zone near the weld of steels with 12% chromium dependent on the cooling speed in intervals of 750 - 650°C. Research has shown that in steels without reinforcing alloys a lower cooling speed leads to a considerable increase of granulation and a decrease of plasticity. Chromium steels with 12% Cr and with reinforced and alloying addition are less sensitive to a change of the thermal cycle parameter when welding, and they have less tendency to an increased granulation in the zone near the weld. Several results given by E. A. Kheyn, Engineer, were used in this study. There are 8 photographs, 1 drawing, 4 graphs, 4 tables and 6 references, 5 of which are Soviet and 1 German.

SOV/135-59-9-3/23

Research on Weldability of Heat Resistant Steels Containing 12% Chromium

ASSOCIATIONS: Institut metallurgii imeni A. A. Baykova AN SSSR (Institute of Metallurgy imeni A. A. Baykov) (Shorshorov, M. Kh. and Belov, V. V.); Tsentral'nyy nauchno-issledovatel'skiy kotloturbinnyy institut imeni I. I. Polzunova (Central Scientific Research Institute for Boilers and Turbines imeni I. I. Polzunov) (Zemzin, V. N. and Smirnova, I. D.)

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SOV/135-59-11-5/26

18(5,7)
AUTHORS: Shorshorov, M.Kh., Candidate of Technical Sciences, Smirnov, B.A., and Belov, V.V., Engineers

TITLE: Peculiarities of Austenite Transformation During Fusion Welding

PERIODICAL: Svarochnoye proizvodstvo, 1959, Nr 11, pp 12-15 (USSR)

ABSTRACT: The weldability of perlite steel is assessed by the alteration of its structure in the zone of welding. The main factor affecting the strength of welds is the content of martensite which should not exceed 20-30%. Depending on the rigidity of the structure, the contents of martensite can be raised up to 50% provided that the work piece will be tempered after welding. In research of austenite transformation during the welding process, the method IMET-1 and dilatation tests were applied; as test-pieces, low-alloy steels 23G, 20KhGS, 35KhGSA, 40Kh and 18Kh2VF were used (Table 1) after the heat-treatment and high tempering at 550-600°C. The process of austenite transformation and growth of grains in steels 23G and 18Kh2VF is shown in Fig 1. The influence of heating speed on the hardness of martensite is illustrated in Table 3. Analysis of

Peculiarities of Austenite Transformation During Fusion Welding

Graphs 3 and 4 discloses the process of austenitic transformation during the cooling. The speed of heating exerts a substantial influence on the processes of austenite homogenization. In steels with a small content of carbide-forming elements, a high temperature in the fusion zone furthers the growth of grains and increases the austenite stability. In steels with carbide-forming elements, a quick heating decreases the homogeneity and stability of austenite. Selection of cooling speed should be performed on the basis of the methods used by IMET-1 or MVTU which take into consideration the peculiarities of austenite transformation during fusion welding. There are 7 graphs, 6 tables and 6 references, 4 of which are Soviet, 1 English and 1 German.

ASSOCIATION: Institut metallurgii imeni A.A. Baykova AN SSSR (Institute of Metallurgy imeni A.A. Baykov, AS USSR)

PHASE I BOOK EXPLOITATION SOV/4508

Akademiya nauk SSSR. Institut metallurgii

Titan i yego splavy, vyp. 3: Metallovedeniye titana (Titanium and Its Alloys, No. 3: Metal Science of Titanium) Moscow, Izd-vo AN SSSR, 1960, 161 p. Errata slip inserted. 2,700 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut metallurgii imeni A.A. Baykova.

Resp. Ed.: N.V. Ageyev, Corresponding Member, Academy of Sciences USSR; Ed. of Publishing House: M.L. Podgoyetskiy; Tech. Ed.: Ye. V. Makuni.

PURPOSE: This collection of articles is intended for scientific research workers and metallurgical engineers.

COVERAGE: The articles summarize results of experimental studies of titanium-base alloys. The microstructure and mechanical properties of titanium-base alloys containing aluminum, chromium or other metals are analyzed along with the effect of oxygen, hydrogen and heat treatment on alloy structure and properties. The tendency of titanium alloys to embrittlement as a result of strain aging is emphasized, and the nitriding of titanium, carried out to increase the surface strength and wear resistance of titanium alloys, is described. Transformations occuring in commercial titanium under conditions of electric heating are examined. Attempts to develop titanium-base alloys capable of withstanding temperatures over 400°C are discussed as are problems of titanium-powder metallurgy and weldability of certain titanium-base alloys. No personalities are mentioned. Most of the articles have bibliographic references, the majority of which are Soviet.

TABLE OF CONTENTS:

SHORSHOROV, M. KH.

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VLADIMIRSKIY, T.A., doktor tekhn.nauk; VROBLEVSKIY, R.V., inzh.; GLEBOV, L.V., inzh.; GODIN, V.M., kand.tekhn.nauk; GUZOV, S.G., inzh.; GULYAYEV, A.I., inzh.; YERSHOV, L.K., inzh.; KOCHANOVSKIY, N.Ya., kand.tekhn.nauk; LYUBAVSKIY, K.V., prof., doktor tekhn.nauk; PATON, B.Ye., akademik, prof., doktor tekhn. nauk; RABINOVICH, I.Ya., kand.tekhn.nauk; RADASHKOVICH, I.M., inzh.; RYKALIN, N.N., prof., doktor tekhn.nauk; SPEKTOR, O.Sh., inzh.; KHRENOV, K.K., akademik, prof., doktor tekhn.nauk; CHERNYAK, V.S., inzh.; CHULOSHNIKOV, P.I., inzh.; SHORSHOROV, M.Kh., kand.tekhn.nauk; BRATKOVA, O.N., prof., doktor tekhn.nauk, nauchnyy red.; BRINBERG, I.L., kand.tekhn.nauk, nauchnyy red.; GEL'MAN, A.S., prof., doktor tekhn.nauk, nauchnyy red.; KONDRATOVICH, V.M., inzh., nauchnyy red.; KRASOVSKIY, A.I., kand.tekhn.nauk, nauchnyy red.; SKAKUN, G.F., kand.tekhn.nauk, nauchnyy red.; SOKOLOV, Ye.V., inzh., red.; IVANOVA, K.N., inzh., red.izd-va; SOKOLOVA, T.F., tekhn.red.

[Welding handbook] Spravochnik po svarke. Moskva, Gos.nauchno-tekhn.izd-vo mashinostroit.lit-ry. Vol.1. 1960. 556 p. (MIRA 14:1)

1. AN USSR (for Paton, Khrenov). 2. Chleny-korrespondenty AN SSSR (for Rykalin, Khrenov).
(Welding--Handbooks, manuals, etc.)

33811

S/137/62/000/001/090/237
A052/A101

12300

AUTHORS: Rykalin, N.N., Kulagin, I.D., Shorshorov, M. Kh.

TITLE: Calculation of dimensions of the fusion zone produced by the surface arc and the welding burner flame

PERIODICAL: Referativnyy zhurnal. Metallurgiya, no. 1, 1962, 4-5, abstract 1E22 (V sb. "Protsessy plavleniya osnovn. metalla pri svarke", Moscow, AN SSSR, 1960, 71 - 100)

TEXT: The calculation is based on the scheme of a normal-circular heat source moving with a finite speed over the surface of a semi-infinite body. The calculation coefficients are determined from a comparison of the calculation data with the experiment. Conclusions: 1) The dimensions of the fusion zone produced by the surface arc and the welding burner flame can be conveniently determined from the width of the fusion isotherm, computed analytically, and also from experimental dependences of the relative depths (the ratio of the fusion zone depth to its width) and the space coefficient μ (the ratio of the fusion zone area to the product of its width by depth) on the welding parameters. 2) The width of the fusion zone, especially for unsunken (superficial) arc and flame,

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Calculation of dimensions ...

depends on the distribution of the heat flow of the source. For the open arc welding with currents up to 250 - 300 a, and an argon-shielded arc gas flame the adopted calculation scheme provides fair results. 3) The calculation of the fusion zone width carried out by this scheme at the arc and torch welding of sheets of a finite thickness describes satisfactorily the experiment, provided that the heat reflection from the lower (unheated) sheet surface does not affect the fusion zone dimensions. 4) The calculation of the fusion zone width at the arc and torch welding of sheets of a finite thickness with an allowance for the heat reflection from the lower sheet surface is a very labor-consuming one. Therefore it is advisable to allow for the effect of the heat reflection by means of a conventional mean heating temperature of the welded sheets, which is determined by comparing the calculation with the experiment.

V. Tarisova

[Abstracter's note: Complete translation]

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A006/A001

18.7200 1506, 1573
1.2300 2208 only

AUTHORS: Shorshorov, M. Kh., Candidate of Technical Sciences, Sedykh, V. S., Engineer, Zemzin, V. N., Candidate of Technical Sciences, Runov, A. Ye., Engineer

TITLE: The Effect of the Ferrite Phase on the Resistance of Austenite Seams to Hot Crack Formation

PERIODICAL: Svarochnoye proizvodstvo, 1960, No. 1, pp. 1-4

TEXT: Electrodes ensuring a 2 to 5% ferrite content in the built-up metal are used for welding heat resistant austenitic steels. A large number of data are now available for regulating the upper limit of the ferrite phase content in the seam and heat treating conditions of weld joints, applied to various operational parameters, types of articles and austenitic steel grades. On the basis of quantitative evaluation methods, experimental results are presented on the effect of the ferrite phase amount on the resistance to hot cracking of metal built up with КТИ-5 (KTI-5), ЦТ-15 (TsT-15), ЗИО-3 (ZIO-3) and ЗИО-7 (ZIO-7) electrodes, and of the seam metal when welding 1Х18Н12Т (1Kh18N12T) steel with these electrodes. Electrodes from TsKTI imeni Polzunov,

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The Effect of the Ferrite Phase on the Resistance of Austenite Seams to Hot Crack Formation

The welding department of TsNIITMASh and the Podol'skiy mashinostroitel'nyy zavod imeni Ordzhonikidze (Podol'sk Machinebuilding Plant imeni Orzhonikidze) were tested. Table 1 contains the composition of electrodes, Cr and Ni equivalents, the equivalence ratio of these components, and the ferrite phase content in the built-up metal, determined by the magnetic method using the TsNIITMASh ferrito-meter. For some compositions of the built-up metal the ferrite phase content was established additionally by metallographical analysis. The resistance of the seam metal to hot cracks was evaluated by the magnitude of the critical rate of its linear deformation when elongated during the crystallization process. This was established by tests on the ИМЕТ-2 (IMET-2) and П-3-4 (P-3-4) machines designed by MVTU. The tests were made with butt(IMET method) and T-welds (MVTU method). The following results were obtained: The index of hot crack resistance (critical rate of linear deformation) of austenite-ferrite built-up metal depends on the amount of the ferrite phase and on the nature of its alloy-int. This index increases from 8 to 12 mm/min for weld metal of 1Х19Н12М2Ф (1Kh19N12M2F) composition with a ferrite content increased from 0 to 4 - 5%.

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The Effect of the Ferrite Phase on the Resistance of Austenite Seams to Hot Crack Formation

A further increase in the ferrite content up to 12% does not affect the proneness to hot cracks. The index of hot crack resistance increases continuously from 3.6 to 11 - 12 mm/min for weld metal of 1X19H9B (1Kh19N9B) composition (TsT-15 and ZIO electrodes) at an increase of the ferrite phase from 0 to 10 - 16%. At a content of the ferrite phase within 0 to 6 - 7%, the index of hot crack resistance of the built-up metal and the seam metal of KTI-4 electrodes is 2 to 1.3 times higher as compared to TsT-15 electrodes when welding 1Khi8N12T steel of a medium grade chemical composition. ZIO electrodes range between both the aforementioned types. A 1:10 ratio of the C and Nb content is recommended to raise the resistance of the built up metal to hot cracks when welding with TsT-15 and ZIO type electrodes. TsT-15 electrodes must ensure a ferrite phase content in the built-up metal not below 5 - 6% and KTI electrodes not below 2 - 3% to obtain resistance to hot cracks when welding root layers of the seam in steel with a higher austenite content (such as 1Kh18N12T steel). The evaluation of hot crack resistance of the seams according to the results of testing butt welds on the IMET-2 machine and T welds on the

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The Effect of the Ferrite Phase on the Resistance of Austenite Seams to Hot Crack Formation

P-4-3 machine yields similar results. It is concluded that in estimating the advantages and selecting the electrode type it is necessary to consider, besides the index of hot crack resistance of the built-up metal, its operational properties depending on temperature, stress, the corrosion medium, the duraction of operation, the type of alloying and the composition of the base metal to be welded. The authors thank Professor K. V. Lyubavskiy, Doctor of Technical Sciences, for his assistance in the work performed. There are 3 figures, 3 tables, and 8 Soviet references.

ASSOCIATIONS: Institut metallurgii im. A. A. Baykova AN SSSR (Institute of Metallurgy imeni A. A. Baykov, AS USSR) Shorshorov and Sedykh; TsKTI imeni I. I. Polzunov (Zemzin); TsNIITMASh (Runov)

SHORSHOROV, M.Kh., NAZAROV, G.V.

Weldability of VT1 titanium and the VT5 titanium alloy. Titan i ego splavy no.3:135-140 '60. (MIRA 13:7)
(Titanium--Welding) (Titanium alloys--Welding)

S/125/60/000/05/03/015

18.7200

AUTHOR: Shorshorov, M. Kh., and Smirnov, B. A.

TITLE: The Kinetics of Austenite-Grain Growth in Steel of Increased Strength in Arc Welding

PERIODICAL: Avtomaticheskaya svarka, 1960, No. 5, pp. 17-25

TEXT: The results of an investigation are given, in which the austenite-grain growth was observed in seven low-alloy steel grades of increased strength and of the pearlite class, in comparison with plain carbon steel "45". The chemical composition of six grades is given ("23G", "40Kh", "25N3", "20KhGS", "35KhGSA", "12KhN2"), the composition of the 7th, "18Kh2VF", is not (Table 1). "Bead specimens" formerly described (Ref. 1) and the IMET-1 method with uniformly and nonuniformly heated specimens were used. The article includes details of the experiment technique. The conclusions drawn are the following: 1) Both methods, "bead specimen" and "IMET-1" produced results differing only little; both methods proved that the grain growth in parent metal at the welds can be restrained by faster heating and shorter duration of austenization temperature, as well as by increased content of carbide-forming elements in steel. 2) Homogenization

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S/125/60/000/05/03/015

The Kinetics of Austenite-Grain Growth in Steel of Increased Strength in Arc Welding

of austenite is low in the case of single-pass welding of 10-mm steel. Marked grain growth took place in the "45", "40Kh", "35KhGSA" and "20KhGS" steel grades only. In single-pass welding of 15-25 mm steel, grain growth was considerably increased in all steels studied, with more homogeneous austenite grain. In the electroslag welding process with 100-300 mm steel, the austenite homogeneity and grain growth were very high. 3) Peculiar grain growth properties of steel were clearly marked only in welding with increased energy consumption ($q/v > 10 \div 12$ kcal/cm), i. e. considerable duration of $t' + t'' > 20 \div 30$ sec. 4) It cannot be determined by the conventional method of maximum grain size evaluation, with isothermic soaking in 930°C ("GOST 5639-51"), if steel tends to grain growth in welding; it has to be done with soaking in temperatures near 1300-1400°C. There are 4 tables, 7 diagrams and 8 Soviet references.

ASSOCIATION: Institut metallurgii im. A. A. Baykova AN SSSR (Metallurgical Institute imeni A. A. Baykov AS USSR)

SUBMITTED: July 20, 1959

IX

S/193/60/000/012/007/018
A004/A001

AUTHOR: Shorshorov, M. Kh.

TITLE: Machine for the Quantitative Rating of the Resistivity of Welding Seams Against Hot Cracks

PERIODICAL: Byulleten' tekhniko-ekonomicheskoy informatsii, 1960, No. 12, pp.21-23

TEXT: The laboratoriya teorii svarochnykh protsessov Instituta metallurgii im. A. A. Baykova An SSSR (Laboratory of the Theory of Welding Processes of the Institute of Metallurgy im. A. A. Baykov of the AS USSR) and the Tsentral'nyy nauchno-issledovatel'skiy institut chernoy metallurgii im. I. P. Bardina (Central Scientific Research Institute of Ferrous Metallurgy im. I. P. Bardin) have designed the ЦНИИЧМ machine for the quantitative rating of the resistivity of welding seams against hot cracks. The following names are given by the author as participants in the design of the machine: M. Kh. Shorshorov, V. S. Sedykh, A. S. Astaf'yev, A. V. Russiyan, V. G. Smirnov, V. A. Ladin, I. P. Artemenko. The operation of the machine is based on the extension of the seam metal with different deformation rates during the crystallization process of the welding bath. The evaluation criterion of the resistivity of the metal of the welding

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Machine for the Quantitative Rating of the Resistivity of Welding Seams Against Hot Cracks

S/193/60/000/012/007/018
A004/A001

seam against the formation of hot cracks is the critical velocity of linear deformation V_{cr} mm/min during which a hot crack originates in the seam. The functional diagram of the machine is shown in Figure 1. Prior to welding one half of specimen 1 is clamped in stationary grips 2. The joining section of the specimen rests on the edge of stationary prism 3. Lever 5 of the bending device acts on the other half 4 of the specimen. The axis of lever 5 coincides with the bending axis of the specimen, i. e. with the edge of prism 3. Lever 5 can be turned with various speeds and is put into motion by sector 6 which serves as its second shoulder. The bending

Fig. 1

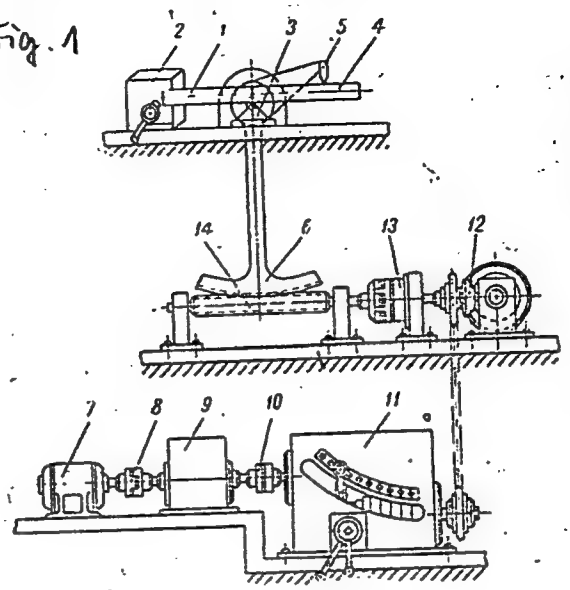

Figure 1:

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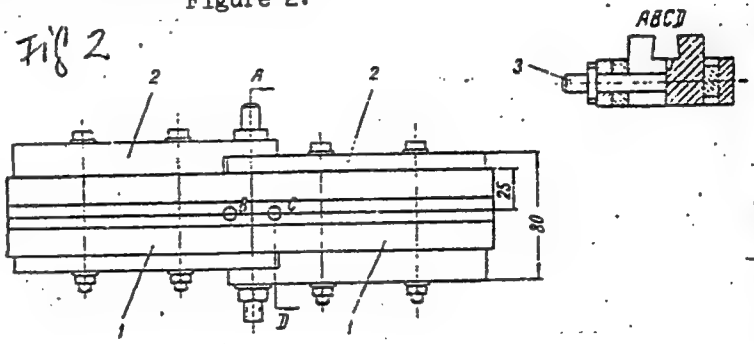
Machine for the Quantitative Rating of the Resistivity of Welding Seams Against Hot Cracks

device mechanism is composed of asynchronous electromotor 7, ring-shaped coupling 8, worm reducer 9, pin coupling 10, Narton-type gear box 11, a pair of bevel gears 12, connected to gear 11 by a chain drive, electromagnetic coupling 13 and worm 14, transmitting the motion of the bending device to sector 6. Figure 2 shows a composite copper mold which is used for testing pure built-up metal. The mold with steel band 2 consists of two halves with common axis of revolution 3 which coincides with joining section A - B. For testing purposes the mold is clamped in the same way as the specimen for the testing of welding seams. Two hollows E and C 20 mm in diameter are located in the bottom of the copper mold. During the building-up process the molten metal

Figure 2:

Fig 2.



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Machine for the Quantitative Rating of the Resistivity of Welding Seams Against Hot Cracks

flows into these hollows and solidifies quickly. Owing to this the built-up shaft is rigidly fixed relatively to each half of the mold and thus a base is created for the deformation of the crystallizing metal of the welding bath relatively to the joining section AB. The author presents the following technical specifications of the IMET-TsNIIChM machine: range of peripheral speed variations of the bending lever with a length of 90 mm - 1.8 - 208 mm/min; range of angular speed variations of the lever - 0.02 - 2.31 mm/min; number of lever revolutions - 0.0032 - 0.368 rpm; maximum bending angle: of specimens - 20°, of the copper mold - 10°; range of dimensional variations of the joint specimens: thickness - 5 - 25 mm; width during tests for transverse cracks 20 - 60 mm; width during tests for longitudinal cracks - not less than 20 mm, i. e. equal to the length of the welding bath; electromotor: power - 50 w; rpm - 1,390; power supply - from the 220 v a-c mains; overall dimensions without welding tractor and control panel - 1,500 x 700 x 240 mm. The machine has been recommended for big-lot production by the GNTK USSR. There are 2 figures.

Card 4/4

GLIZMANENKO, Dmitriy L'vovich; YEVSEYEV, Georgiy Borisovich; SHORSHOROV, M.Kh., kand. tekhn. nauk; VASIL'YEV, K.V., kand. tekhn. nauk, retsenzent; CHERNYAK, O.V., red. izd-va; CHERNOVA, Z.I., tekhn. red.

[Gas welding and cutting of metals] Gazovaia svarka i rezka metallov. Izd.2., perer. Moskva, Gos. nauchno-tekhn. izd-vo mashinostroit. lit-ry, 1961. 447 p. (MIRA 14:8)
(Gas welding and cutting)

89665

S/135/61/000/003/001/014
A006/A001

12300

AUTHORS: Sokolov, Yu. V., Engineer, Shorshorov, M. Kh., Candidate of Technical Sciences

TITLE: Modifying Halide Fluxes for Welding Nickel Alloys

PERIODICAL: Svarochnoye proizvodstvo, 1961, No. 3, pp. 1-5

TEXT: Fused halide fluxes, composed of fluorine and chlorine salts of alkali and alkali earth metals, are used in automatic welding of heat-resistant nickel alloys and austenitic steels. To improve the technological properties of these fluxes, the laboratory of the theory of welding processes at the Institute of Metallurgy imeni Baykov, AS USSR, was developing during 1957-59 fused halide fluxes assuring higher crack and heat resistance of the weld metal, due to a 70 - 100% transition of the alloying element into the base metal. An investigation of binary and ternary systems of fluorine and chlorine salts showed that for welding Ni-alloys best technological properties are offered by the CaF_2 - $BaCl_2$ binary system. To raise the resistance of welds to hot cracks, small amounts of active modifying elements, such as Na and Sr, in the form of NaF and SrF_2 fluorine salts were added to the slag. According to V. K. Semenchenko's theory

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S/135/61/000/003/001/014
A006/A001

Modifying Halide Fluxes for Welding Nickel Alloys

(Ref. 3) modification of metals and alloys is considered as an increase of their dispersity under the effect of negligible amounts of surface-active substances having a lower generalized moment than the solvent metal. Generalized moments of alloying elements, contained in the nickel alloys and fluxes were calculated. (Figure 1) Their comparison shows that the flux components are surface-active in respect to the components of the heat resistant nickel alloys. It is assumed that ion-exchange reactions proceed on the liquid phase-flux interface between the most active elements: the flux and the metal of the drops, the flux and the welding pool. Thermodynamical calculations of these reactions show the possibility of their occurrence, and prove together with chemical analyses that some modifiers may transfer from the flux into the seam metal. The effect of modification on crack resistance was studied by the IMEF-2 method (Ref. 8). The authors chose as a criterion, the value of the critical tensile deformation speed (V_{cr} mm/min) of the weld metal during crystallization when the hot crack begins to form. Hot crack resistance of the weld metal was tested by building up in a composite copper mold (Fig. 4), using ЭИ437 (EI437) and ЭИ868 (EI868) electrodes (composition see table 1), 300 - 400 amps d-c of reverse polarity; 30 - 32 v arc voltage and 145 - 160 mm/min welding speed. The tests were made with standard fluxes АН-26 (AN-26) and АН-5 (AN-5) and experimental fluxes of the ИМЭТФ(IMETF) type which were manufactured by alloying CaF_2, $BaCl_2$, NaF and SrF_2 in a 1kg-

Card 2/

crucible in a high-frequency furnace. Results showing the effect of the flux on crack sensitivity of the weld metal are given in Figure 5. The chemical analysis of metals built-up with standard and experimental fluxes is given in Table 3. It was found that the acicular crystal structure of the metal built up with EI437 wire under AN-26 flux showed a lower resistance to crack formation; this is explained by the correlation between the extent of crystal boundaries and the ductility of the metal in the brittle temperature range during crystallization. It is beyond any doubt that cracks are forming as a result of intercrystalline failure. As to the formation of cracks in single-phase nickel alloys and pure austenitic steels there are 2 different opinions: 1) the cracks are developing along the initial crystallytes 2) the cracks are connected with the appearance of polygonization of the cast structure, causing the formation of new boundaries which represent accumulations of submicroscopic defects of the crystal lattice. On the basis of the data obtained, the authors support the latter point of view. The tests performed lead to the following conclusions: In welding nickel alloys, modifying fused halide fluxes are chemically active in respect to the welding pool. It is shown that the NaF content of these fluxes should be reduced in order to increase Al and Ti transition from the electrode wire to the weld metal and in order to raise its heat resistance. The modifying effect of Na and Sr, contained

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S/135/61/000/003/001/014
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Modifying Halide Fluxes for Welding Nickel Alloys

in halide fluxes, is ensured by a low content of fluorine salts (3 - 5%) (IMTF type flux). The resistance to cracks of the weld metal at a low content of fluorine salts is not less than at a higher content of NaF (ANF-5 flux). The joint effect of modifiers (Na and Sr) and the alloying of built-up metal with tungsten, increases the resistance to hot cracks of nickel alloys during welding process. It is confirmed that hot crack resistance can be raised by eliminating polygonization by alloying the weld joints with tungsten. The authors recommend IMETF-71, IMETF-27 and IMETF-4 fluxes for welding with EI437 and EI868 electrodes.

Figure 1:

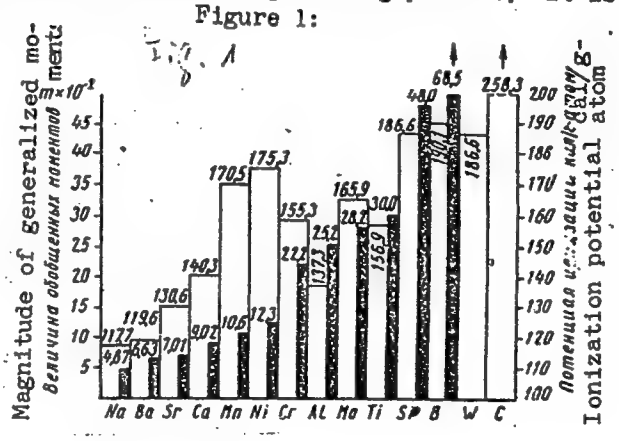

Figure 1:
Generalized moments and ionization potentials of elements contained in nickel alloys and modifying fused halide fluxes.

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SHORSHOROV, M. Kh., kand.tekhn.nauk; SMIRNOV, B.A., inzh.

Heterogeneity of austenite in the fusion welding of pearlitic steel.
Svar. proizv. no.6:1-5 Je '61. (MIRA 14:6)

1. Institut metallurgii im. A. A. Baykova AN SSSR.
(Steel—Welding)
(Steel—Metallography)

S/135/61/000/008/001/011
A006/A101

AUTHORS: Shorshorov, M.Kh., Candidate of Technical Sciences, Kodolov, V.D., Engineer

TITLE: Notch sensitivity of low-alloy and carbon steels in arc welding

PERIODICAL: Svarochnoye proizvodstvo, no. 8, 1961, 1 - 4

TEXT: The authors investigated the effect of arc welding on the notch sensitivity in the weld-adjacent zone of the following carbon and low-alloy steel grades: 45, 40Х (40Kh), 35ХГСА (35KhGSA), 20ХГС (20KhGS), 25Н3 (25N3), 23Г (23G) and 12ХН2 (12KhN2). Fillets were submerged-arc-welded on 16 mm thick plates at the following values of linear arc energy: $(\frac{q}{v})$: 2,000, 4,800, 7,800, 11,000, 13,200 and 17,000 cal/cm. Standard Schnadt and Menager specimens with notches of 0.025, 0.5 and 1 mm chamfering radius were cut out of the plates and the base metal. Hardened steel pins were inserted into the specimens which were then subjected to impact tests on a ram at room temperature. The results obtained with Schnadt specimens were compared to those of tests made with Menager specimens at room and negative temperatures (below 0°C). It was established that the steels investigated were of the "semibrittle" type according to Schnadt's

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Notch sensitivity ...

terminology. 40Kh, 45 and 35KhGS steels are more notch-sensitive in the weld-adjacent zone than 23G, 25N3 and 12KhN2 steels. At low values of linear arc energy and high cooling rates, the metal of the weld adjacent zone of 40Kh and 45 grade steel becomes "brittle" due to abrupt quenching. The steels of the first group are highly notch-sensitive, and the toughness of the weld-adjacent zone is, as a rule, below that of the base metal, even within the optimum range of changes in the linear arc energy in single-layer welding. For steels of the second group the thermal cycle of building-up acts as an improving heat treatment and causes increased toughness of notched specimens over the weld-adjacent zone as compared to the base metal. During the tests of the second group of steels, the toughness of Schnadt specimens with a 0.5 mm radius of the notch base, was in all cases below, and at a 1 mm radius, above that of standard Menager specimens. For steels of the first group, when building-up is performed at relatively low values of linear energy ($\frac{q}{v}$ = 2,000 cal/cm) the toughness of Menager specimens is even lower than that of Schnadt samples with 0.025 mm notch radius. This indicates a substantial effect of the scale factor. Schnadt specimens have no special advantages over Menager specimens in establishing optimum welding conditions of high-strength steels by the method of notched-weld tests, but their manufacture is much more labor-con-

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Notch sensitivity ...

suming. The information includes a series of graphs showing the effect of the linear arc energy and temperature on the toughness of Schnadt and Menager specimens. There are 1 table, 7 figures and 4 references: 3 Soviet-bloc and 1 non-Soviet-bloc (H.M. Schnadt: On notch brittleness tests employing a notched weld, "The Welding Journal", no. 1, 1957)

ASSOCIATION: Institut metallurgii im. A.A. Baykova AN SSSR (Institute of Metallurgy imeni A.A. Baykov, AS USSR)

Card 3/3

22699
G/014/61/000/008/002/002
D029/D109

1.2300 1573

AUTHORS: Shorshorov, M. KH., and Nazarov, G. V. (Moscow)

TITLE: The kinetics of phase transitions and the formation of cold cracks in welding of titanium and its alloys

PERIODICAL: Schweisstechnik, no 8, 1961, 356

TEXT: The article is an extract of a thesis put to discussion on the 2nd International Colloquy "Schweissmetallkunde und Metallurgie der Nichteisenmetalle" (welding and metallurgy of non-ferrous metals), of the ZIS, Weimar 1961. The original and a translation in German are available at the ZIS. Tests were carried out with tubes of 6 mm length and 6 mm diameter with a wall thickness of 1 mm. Test bodies were heated to 1200°C or 1300°C with high-frequency current. The heating velocity in the $\alpha \rightarrow \beta$ transition range amounted to 300°C/s. The cooling velocity was varied between 4 and 450°C/s. The following results were obtained: 1) During welding of titanium and its alloys the temperature range of the $\beta \rightarrow \alpha$ transition shifts to the temperature region from 800 to 500°C with an increase of the cooling velocity up to 400-450°C/s. 2) The cooling velocity has a complicated

Card 1/2

S/135/62/000/004/005/016
A006/A101

16.1700

AUTHORS: Shorshorov, M. Kh., Candidate of Technical Sciences, Sokolov, Yu. V., Engineer

TITLE: The temperature range of hot crack formation in flash welding of single-phase nickel alloys

PERIODICAL: Svarochnoye proizvodstvo, no. 4, 1962, 9-11

TEXT: The temperature range of hot crack formation in the weld metal of nickel alloy Х25Н60Е15 (ЭИ868) [Kh25N60V15 (EI868)] was determined on a ИМЭТ-2 (IMET-2) machine from the critical deformation rate of the crystallizing metal. Submerged-arc building-up was performed with 3 mm diameter EI868 wire and ИМЭТФ-27 (IMETF-27) flux in a dismountable copper mold mounted on the machine punch. On the mold bottom five pieces of the same wire were placed. Its design assured deformation of the root layer of the built-up metal along the bead axis on 20 mm basis. Building-up was made with a АДС-1000-2 (ADS-1000-2) automatic machine, 380 - 400 amps current, 30 - 32 v arc voltage, 160 mm/min welding speed, 50 - 55 mm long welding pool. Deformation speed changed from 3.6 to 34 mm/min and the deformation time was varied, so as to determine the arising of a crack

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The temperature range of hot crack formation ...

in the lower layers of the bead over the section of the mold joint. Final deformations of the bead were measured from the magnitude of the gap formed between the mold halves in the section of its joint at the level of the lower bead layers; they were compared with data from calculations of the speed and time of deformation. Two tungsten-rhenium thermocouples were placed in an aperture at the mold bottom. The results obtained are represented in graphs. It was established that hot cracks in the welds of a single-phase nickel alloy EI868 (Kh25N60V15) arose within a temperature range, from the solidus to 1,000-950 °C, in which the development of the polygonization process was most probable. A dip of ductility was observed in this temperature range. Least ductility occurs between the solidus and 1,200°C and amounts to 0.5 - 0.6%. Hot cracks arise along the polygonization boundaries. When analyzing the ductility of alloys in the brittle temperature range, as one of the characteristics determining the technological strength reserve, both the absolute ductility value and the nature of its changes should be taken into account. There are 4 figures and 14 references: 13 Soviet-bloc and 1 non-Soviet-bloc.

ASSOCIATION: Institut metallurgii imeni A. A. Baykova (Institute of Metallurgy imeni A. A. Baykov)

S/135/62/000/004/006/016/
A006/A101

18.1130

AUTHORS: Shorshorov, M. Kh., Candidate of Technical Sciences, Sokolov, Yu. V., Engineer, Russiyan, A. V., Candidate of Technical Sciences, Matsnev, E. P., Engineer, Kurkina, N. I., Candidate of Technical Sciences

TITLE: The effect of the composition and structure of chrome-nickel steels and alloys on hot crack formation in the weld-adjacent zone

PERIODICAL: Svarochnoye proizvodstvo, no. 4, 1962, 12-17

TEXT: The authors studied the effect of some alloying elements, such as boron, aluminum, titanium, carbon and others, and also of the initial state of various steels and alloys on changes in their ductility and strength under thermal cycle conditions of the weld-adjacent zone in welding. The investigation was carried out by the ИМЕТ-1 (IMET-1) method described in references 6 and 7. The results of the investigation are given in a table which contains also data on martensite, austenite-martensite and austenite-ferrite steel for comparison with chrome-nickel austenite steels and nickel alloys. The following conclusions are drawn. The proneness of alloys with similar alloying systems, to hot crack formation can be comparatively evaluated from the temperature when ductility and

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The effect of the composition ...

strength, determined in impact tension under conditions of the thermal welding cycle, are beginning to be recovered. Chrome-nickel austenite steels are more prone to hot crack formation in the weld-adjacent zone than austenite-ferrite, austenite-martensite and martensite steels. Cracking sensitivity of austenite steels increases with a higher nickel content. Proneness to hot cracks in the weld-adjacent zone of chrome-nickel austenite steels and nickel alloys increases with a higher content of boron, aluminum, titanium and carbon. However, in nickel alloys, the negative effect of boron is very marked at a higher content ($>$ 0.01 - 0.02%) than in austenite steels ($>$ 0.005 - 0.007%). Proneness to hot cracks in the weld-adjacent zone of austenite steels and nickel alloys can be reduced by refining the base metal with the aid of electric slag remelting or vacuum melting, grain refining, and increasing the quenching temperature within the limits of a permissible grain size. All these methods reduce segregation of alloying elements and harmful impurities at the grain boundaries: the former, indirectly, by reducing the total amount of impurities in the alloy and by their more uniform distribution; the latter two, directly, by reducing the concentration of elements and impurities at the boundaries. The study was carried out with the participation of Engineer V. V. Belov, and Candidate of Technical Sciences V. S. Sedykh from the Institute of Metallurgy imeni A. A.

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The effect of the composition ...

Baykov and Engineer Yu. P. Glukhov. The authors thank Candidate of Technical Sciences V. N. Zemzin from the TsKTI imeni I. I. Polzunova, for his assistance. There are 5 figures, 1 table and 8 references: 6 Soviet-bloc and 2 non-Soviet-bloc.

ASSOCIATIONS: Institut metallurgii imeni A. A. Baykova (Institute of Metallurgy imeni A. A. Baykov)(Shorshorov and Sokolov); TsNIIChM imeni I. P. Bardin (Russiyan and Matsev)

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S/180/62/000/004/002/009
E193/E383

AUTHOR: Shorshorov, M.Kh. (Moscow)

TITLE: The role of vacancies in the delayed fracture of steel and titanium alloys

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo, no. 4, 1962, 70 - 77

TEXT: In the case of certain materials, including steel and Ti-base alloys, the true breaking stress σ_p at room temperature rapidly decreases with increasing time-to-rupture t_p : This effect, known as the delayed fracture, is demonstrated by data (of the present author, V.P. Belov and G.V. Nazarov) reproduced in Fig. 1, where σ_p (kg/mm^2) is plotted as a function of t_p (min) for specimens tested at room temperature after a preliminary treatment which consisted of heating to a temperature near the solidus and cooling rapidly in air; curves 1-5 relate to the following specimens: 1 - alloy ВТ-6 (VT-6) with 0.2% O, 0.01% H

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The role of vacancies in ....

and 0.03% N; 3 - ditto but with an oxygen content of 0.3 - 0.4%; 2 - martensitic steel 40X (40Kh); 4 - ditto but tested at 50 °C; 5 - martensitic steel 45X (45Kh). There is a close connection between the development of cold cracks in the heat-affected zone of welded structures and the proneness of an alloy to delayed fracture - hence the present paper, in which the author analyses a large body of experimental data in order to establish the mechanism of both these phenomena. He concludes that the decisive factor in either case is the presence of excess vacancies, formed as a result of quenching or plastic deformation caused by volumetric changes, associated with solid-state transformations at low temperatures (martensitic transformation in steels, precipitation of hydrides in hydrogen-contaminated Ti alloys, etc.). He shows that analysis of the interaction between the elasto-viscous grain-boundary flow, on the one hand, and the movement of vacancies towards boundaries normal to the direction of the applied stress and towards other vacancy sinks on the other, made it possible not only to explain the part played by stresses of the first and second type in initiation and propagation of microcracks but also

The role of vacancies in ....

to determine the conditions under which "recovery" can take place. It is possible to assess in the frame of this mechanism of delayed fracture the relative importance of various technological factors, responsible for the specific features of this effect in steel and Ti-base alloys. The results of the present work indicate that in studies and development of metallic materials of construction it is necessary to consider the effect of alloying additions not only on the kinetics of the phase transformations but also on the concentration of excess vacancies and other point defects of the lattice.
There are 5 figures.

SUBMITTED: April 9, 1962

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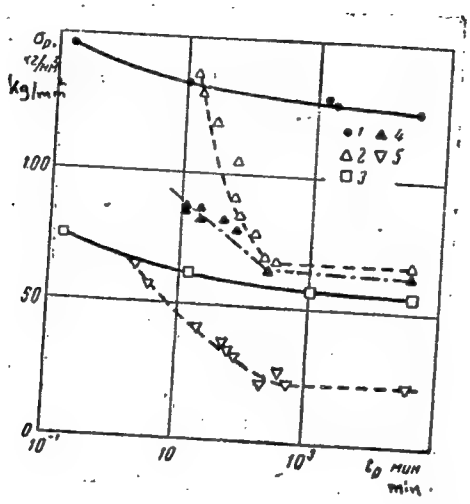
The role of vacancies in ....

S/180/62/000/004/002/009
E193/E383

Fig. 1:



Card 4/4

3870
S/598/62/000/007/031/040
D217/D307

18.1285

AUTHORS: Shorshorov, M. Kh. and Nazarov, G. V.

TITLE: Kinetics of phase transformations and formation of cold cracks on welding titanium and its alloys

SOURCE: Akademiya nauk SSSR. Institut metallurgii. Titan i yego splavy. no. 7, Moscow, 1962. Metallokhimiya i novyye splavy, 226-233

TEXT: The following materials were used for the study of the kinetics of transformation: Commercially pure titanium BT1 (VT1) (0.0075% H_2) and OT4 (OT4) alloys of two melts with different hydrogen contents (3% Al, 1.8% Mn, 0.0055 and 0.018% H_2), AT3 (AT3) (3% Al, 1.1% Cr + Fe + Si and 0.01% H_2), AT4 (4% Al, 1.4% Cr + Fe + Si and 0.0055% H_2) and AT8 (7.1% Al, 0.8% Cr + Fe + Si and 0.006% H_2). The oxygen and nitrogen content of all alloys did not exceed 0.1 - 0.12% and 0.04 - 0.05% respectively. For the investigation

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of cold crack formation one of the severest welding tests was carried out, namely, the cross test. Alloys OT4 (0.0055% H_2), AT3 (0.01% H_2) and AT8 (0.05% H_2) were tested. The oxygen and nitrogen contents were within the technically permissible limits ($N_2 \leqslant 0.04$ - 0.05; $O_2 \leqslant 0.1$ - 0.12%). It was found that on welding commercially pure Ti and its alloys with subsequent increase in cooling rate to 400 - 450°/sec, a considerable displacement of the temperature interval of the $\beta \longrightarrow \alpha$ transformation occurs in the temperature range 800 - 500°C. The cooling rate exerts a complex influence on the temperature at which hydride transformation is initiated and on the nature of hydride precipitation. The hydride transformation takes place during cooling and subsequent resting at room temperature, with an increase in volume which is the greater, the higher the hydrogen content of the alloy. The hydrogen content exerts the most important influence on the tendency of Ti and its alloys to form cold cracks. At a total oxygen + nitrogen content of 0.14 - 0.17% which can usually be attained under conditions of

contemporary Ti production, the total hydrogen content of the basis metal and alloy metals should be limited to 0.008% in order to ensure good quality welds free from cold cracks in rigid welded joints. There are 7 figures.

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38705
S/598/62/000/007/032/040
D217/D307

1,2360
18 1285

AUTHORS: Nazarov, G. V. and Shorshorov, M. Kh.

TITLE: Welding characteristics of the titanium alloys AT3 (AT5), AT4, AT6 and AT8

SOURCE: Akademiya nauk SSSR. Institut metallurgii. Titan i yego splavy. no. 7, Moscow, 1962. Metallokhimiya i novyye splavy, 234-239

TEXT: The weldability of Ti alloys was studied in order to determine accurately the limits of alloying within which satisfactory welds can be obtained, The study was carried out at the Theory of Welding Process Laboratory of the Institut metallurgii imeni A. A. Baykova AN SSSR (Institute of Metallurgy imeni A. A. Baykov, AS USSR) in 1958-1959. The investigations included mechanical testing and metallographic analysis of the welded joints as well as of the basis metal in the heat-affected zone. A detailed study of the reaction of the basis metal to the thermal cycle during welding was carried out. The alloys were produced by twofold vacuum remelting.

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Welding characteristics of ... S/598/62/000/007/032/040
D217/D307

The total oxygen and nitrogen content of the alloys did not exceed 0.16 - 0.18%. Sheets of 3 mm thickness were used immediately after rolling and etching. It was found that with contents of ß-stabilizing elements between 0.6 and 0.8%, the properties of Ti alloys of the system Ti-Al-Cr-Fe-Si-B in the heat-affected zone are changed to an insignificantly small extent, for a very wide range of parameters of the thermal cycle of welding (the cooling rates and soaking times of the metal being above the $\alpha \rightarrow \beta$ transformation temperature). The properties of the welded joints in these alloys decrease somewhat as compared with the basis metal if the aluminum content of the alloy does not exceed 4.5%. In the presence of 1.3 - 1.6% of ß-stabilizing elements, the alloys tend to harden and overheat under welding conditions. At a ß-stabilizing content of 2.3 - 2.8%, the alloys become very prone to hardening in the zone adjacent to the joint. The properties of alloys containing 3.5 - 4.5% Al and 0.6 - 1.3% ß-stabilizing elements decreases to only a very slight extent after welding. Alloys of this system exhibit a satisfactory weldability if the U.T.S. of the basis metal after rolling does not exceed 95 - 105 kg/mm^2. There are 4 figures.

Card 2/2

SOKOLOV, Yu.V., kand.tekhn.nauk; SHORSHOROV, M.Kh., kand.tekhn.nauk

Effect of the composition of halide fluxes on the properties of welded joints in chromium-nickel alloys. Svar. proizv. no.3:1-4 Mr '63. (MIRA 16:3)

1. Institut metallurgii im. A.A.Baykova.
(Chromium-nickel alloys--Welding)
(Flux (Metallurgy))

L 10303-63 EWP(k)/EWP(q)/EWT(m)/BDS--AFFTC/
ASD--Pf-4--JD/HM
ACCESSION NR: AP3001114 S/0125/63/000/007/0001/0007

AUTHOR: Krasulin, Yu. L.; Shorshorov, M. Kh.

TITLE: Wedge test for evaluating the effect of cooling rate on the polygonization of single-phase-structure welds

SOURCE: Avtomaticheskaya svarka, no. 7, 1963, 1-7

TOPIC TAGS: welding wedge test, EI868 alloy, polygonization of welds

ABSTRACT: A weld-testing wedge made from OKh18N9T austenitic steel was used to determine the critical rate of cooling at which the polygonization of EI868 (Kh25N60B15) heat-resisting nickel alloy is suppressed. The alloy was welded on by an independent double-electrode arc, with a 1.6-mm welding wire. EI868 alloy is a single-phase solid solution strengthened by (about 16 per cent of) tungsten. Metallographic studies revealed that at the cooling rate of over 100 or 120C per sec. the polygonization boundaries in the welded-on metal disappear. Five microphotographs are presented. Additional alloying of 8 per cent Mo (Mo-wire added in the welding arc) resulted in reducing the cooling rate to 40C per sec. The critical rate of deformation, which determines the hot-crack resistance of the welded-on metal, was found to be 2.8 and 7.3 mm per min. for EI868 and EI868 plus Mo

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L 10303-63
ACCESSION NR: AP3001114

respectively. Orig. art. has: 5 figures, 4 formulas, and 1 table.

ASSOCIATION: Institut metallurgii im. A. A. Baykova (Institue of Metallurgy)

SUBMITTED: 10Jan63 DATE ACQD: 02Aug63 ENCL: 00

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Card 2/2

KRASULIN, Yu.L., inzh.; SHORSHOROV, M.Kh., kand. tekhn. nauk

Regulating heat and diffusion processes in the metal fusion zone during welding and hard facing. Svar. proizv. no.8:13-16 Ag '63. (MIRA 17:1)

1. Institut metallurgii imeni A.A. Baykova.